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Guide to Information on Research in Marine Science and Engineering



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Guide to Information on Research in Marine Science and Engineering

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Prepared by:

U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Office of Ocean Engineering

FOREWORD

This Guide to Information on Research in Marine Science and Engineering is a revision and expansion of the 1977 Guide. It should improve user ability to obtain access to ongoing research information as well as a much greater range of federal and non-federal data and information bases. This brochure also has descriptions of the ocean research and development responsibilities of several federal agencies, including source contacts for further assistance.

User comments on this brochure are welcome and should be addressed to:

Director

Office of Ocean Engineering

National Oceanic and Atmospheric

Administration

Rockville, Maryland 20852

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AGENCY PROGRAMS IN MARINE SCIENCE AND ENGINEERING

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Marine research and development within the National Oceanic and Atmospheric Administration (NOAA) covers a wide spectrum of activities in biology, ecology, physical oceanography, and systems development that contribute to NOAA's goal of ensuring wise development and rational conservation of ocean resources for the economic and social good of the nation.

Studies of marine life distribution and the effect of pollutants and other environmental stresses upon their habitat are given special emphasis. These studies, conducted by NOAA laboratories, contractors, and universities, deal with commercial and sports fishing areas, conservation of endangered species, microconstituent research, environmental impact assessment, and overall management of living marine resources. Included are programs designed to assure that only safe and wholesome fishery products reach the consumer. Important research is being carried out by a network of national Sea Grant institutions and state agencies, which receive matching federal grants to seek solutions to problems relating to the management and use of marine resources, and marine technology transfer.

Considerable emphasis is also being placed on detailed physical and biological analyses of large marine ecosystems, such as the New York Bight and Puget Sound, to provide ecological data needed for balanced use of the marine environment and its resources. Assessing the impact of ocean dumping and waste disposal on marine ecosystems is a vital part of research conducted by several laboratories, which includes related studies of ocean circulation, coastal upwelling, and tides.

The impact of the development of nonliving resources, such as gas, oil, and minerals on coastal and deep ocean areas is being studied in an attempt to establish base-lines from which environmental changes can be measured and to predict future environmental impact in order to avoid irreversible damage to marine life. Also,

through investigation of the air-sea interface vital knowledge is being obtained for weather forecasting and for warning announcements of floods, waves, tides, and hurricanes to all segments of the population.

These activities are supported by an oceanographic research and survey fleet that also participates in extensive mapping and charting; aircraft; ocean engineering instrumentation systems, buoys, and manned underwater submersibles; and satellite and remote sensing devices, including visible, infrared, and microwave radiometers, as well as conventional instrumentation.

Major components of NOAA carrying out this research are the National Marine Fisheries Service, the Environmental Research Laboratories, the Office of Sea Grant, the National Environmental Satellite Service, the National Weather Service, the National Ocean Survey, and the Environmental Data and Information Service (formerly the Environmental Data Service).

The *National Environmental Satellite Service* (NESS) manages and operates the environmental satellite systems. High resolution data are used to map ocean and lake thermal gradients and lake and sea ice concentrations. NESS also uses data from Landsat and Nimbus satellites to study the color, biology, pollution, and sea state of marine areas.

The *National Weather Service* (NWS), through investigation of the ocean's temperature and current systems, is obtaining vital knowledge for improving weather prediction. New measurement and ocean prediction techniques are under development which will improve forecasts and warnings of coastal storm flooding, hurricanes, and ocean waves for many segments of the population.

The *National Ocean Survey* (NOS) conducts programs in marine science, engineering, and development to support NOAA programs in mapping, charting, oceanographic surveying and monitoring, geodesy, and vessel operation.

Most of this marine research is centered in the Office of Marine Technology (OMT) which is responsible for the design, development, test, and evaluation of marine sensing instruments, their supporting hardware, software, and associated data processing systems. In addition, OMT maintains a federal facility for oceanographic instrumentation testing and evaluation, and the development of calibration methods and test standards on a national basis. The Office of Marine Technology also assesses requirements and formulates the design of systems for collection and processing of oceanographic,

marine meteorological and related marine environmental data.

For further information write to:

Director, Environmental Science Information Center
(D8)

Environmental Data and Information Service
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

Maritime Administration

The Maritime Administration (MarAd) promotes the development, operation, and maintenance of an efficient American-flag merchant marine capable of meeting the commercial and military shipping requirements of the United States. It assists the maritime industry by promoting shipper patronage of U.S.-flag vessels, developing advanced transportation systems and shipboard equipment, evaluating ship design, training merchant marine officers, and providing financial support to American shipbuilders and operators to narrow the cost advantages enjoyed by their foreign competitors.

MarAd carries out a broad research and development program to improve the productivity and competitive posture of the U.S. merchant marine through technological innovations. The program follows two parallel paths that correspond to the structure of the maritime industry itself. Advanced Ship Development studies deal with the technologies of ship building, ship machinery, and nuclear merchant ships. Advanced Ship Operations projects deal with ship and cargo operations generally, ship control technology, and navigation and communication.

Basic research is done on the classical naval architecture technologies of propulsors, structures, and hydrodynamics. Emphasis is on advanced propellor designs and materials to achieve improved efficiency. For example, a highly skewed propellor has been developed which allows the application of higher horsepower with little or no vibration and thus greater efficiency and reduced maintenance. Investigations are conducted, in cooperation with other agencies and the National Academy of Sciences, to determine the effects of sea loads and vibrations on ship structures. Hydrodynamics projects are aimed at improving the efficiency of moving vehicles through the sea with emphasis on powering technology, speed, and maneuvering characteristics and limitations. Further exploratory research involves hu-

man factors, ship automation and communications, and energy and environmental research.

An important tool developed for the in-house work on maritime research is the Computer Aided Operations Research Facility (CAORF). At this unique simulator, built around a typical ship wheelhouse and control center and with computer-generated images of the changing scene projected on a wide, cylindrical screen, simulated ships of all types can be maneuvered through any harbor configuration or environmental and traffic situation in real time. Many of the tests at CAORF enable study of human reactions to complex problems, new equipment, passage through dangerous channels, and any number of other conditions to improve the safety and productivity of ship operations.

For further information write to:

Assistant for Program Development
Office of Commercial Development
Maritime Administration
14th and E Streets, N.W.
Washington, D.C. 20230

The Maritime Administration's *Maritime Research Information Service* (MRIS), operated for the U.S. maritime industry, is designed to provide comprehensive information on proposed, ongoing, and completed research and development projects and to technical reports and journal articles. In addition to U.S. research information, the data files as of 1977 also contain abstract information from the British Ship Research Association and the Ship Research Institute of Norway ("Ship Abstracts").

"MRIS Abstracts" is published and distributed every six months and contains all the information collected during that period, as well as a key word and authors index, and a publisher/performing/funding agency list.

The "Current Awareness Service" is published monthly, and, in addition to the information collected during the period, contains a list of meetings and conferences, citations of transportation articles, and reports prepared in cooperation with the Transportation Center, Northwestern University.

MRIS also offers computerized literature searches of the data files to compile selected bibliographies with abstract, author, source of the document, and any of the other information in the system.

For further information write to:

Maritime Research Information Service
Transportation Research Board
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

DEPARTMENT OF DEFENSE

Department of the Navy

Marine research and development designed to meet Navy requirements include a variety of projects, among them the following: improvement in tidal predictions and better understanding of energy transfer in coastal processes; sea-state observations through correlation of electromagnetic backscatter with wave spectra; environmental support for deep ocean operations through enhanced capabilities for remote data gathering; increased understanding of the dynamics of deep ocean mooring systems for buoyed oceanographic sampling packages; use of SEASAT in the study of surface oceanographic conditions; marine biological research dealing with boring and fouling organisms and animals that affect acoustic transmission in the ocean; identification of communities in the deep scattering layer and correlation of the location of the layer with physical parameters; and determination of the contribution of marine mammals to oceanic ambient noise.

In ocean engineering, projects are underway to expand work in the deep ocean by manned and unmanned submersibles and by divers. The Large Object Salvage System, begun in 1965 and nearing completion, makes it possible to salvage objects weighing up to 1,000 tons from depths down to 850 feet. Another project designed to extend this capability to 20,000 feet has begun. In biomedicine, deep nitrogen-oxygen saturation chamber exposure tests are being made to define limits of human performance under nitrogen narcosis. Decompression principles are being studied for both shallow dives from nitrogen-oxygen exposures to 100 feet and shallow and intermediate depth excursions while breathing helium-nitrogen-oxygen tertiary mixtures. An Environmental Health Effects Laboratory for investigating diver physiology to simulated depths of 3,400 feet is scheduled for completion in 1977.

For further information write to:

Office of the Oceanographer of the Navy
Code N45
Hoffman Building II
200 Stovall Street
Alexandria, Virginia 22322

U.S. Army Corps of Engineers

The marine research and development programs of the U.S. Army Corps of Engineers pertain to the Corps' civil works responsibility in the coastal zone and the nearshore ocean areas, with results primarily applicable to shore protection and navigation studies, as well as to the understanding and dissemination of knowledge concerning coastal processes and nearshore oceanography.

Specific programs include coastal hydraulics, sediments, and structures; structure-sediment-hydraulics interactions; coastal ecology, beach nourishment techniques; systems for sand-bypassing; and navigation channel dimensions and alinements. Results of these programs, and of the many subtasks within them, are disseminated in the form of research reports, papers, technical memoranda, and regulations.

A number of congressionally directed studies are also being carried out. The dredged material research program, for example, provides definitive information on the environmental impact of dredging and dredged material disposal operations. Another objective is to develop technically satisfactory, environmentally compatible, and economically feasible dredging and disposal alternatives, with consideration given to dredged material as a manageable resource. Additional areas of research include island and marsh habitat construction, mariculture involving dredged materials, and tractability of consolidated fine materials.

In the Chesapeake Bay Study, a comprehensive study of the Bay waters and associated land resources, a physical model, 14 acres in area, is being used to aid in the investigation of management alternatives for the use of the Bay's resources.

Two laboratories are responsible for most of the Corps' research development activities: The Coastal Engineering Research Center, Fort Belvoir, Virginia; and the Waterways Experiment Station, Vicksburg, Mississippi. The former is in charge of conceiving, planning, conducting, and publishing the results of research and data collection in coastal engineering and nearshore oceanography, including shore and beach erosion con-

trol; flood and storm protection; the location, layout, design construction, operation, and maintenance of harbor, coastal, and offshore structures; navigation improvement; and recreation. The Center is equipped with wave tanks and coastal processes basins, and has full-scale field facilities on both the Atlantic and Pacific coasts.

The Waterways Experiment Station, the Corps' main research, testing, and development facility, supports the civil and military missions of the Chief of Engineers and other federal agencies through the operation of a complex of laboratories in the fields of hydraulics, soil mechanics, concrete, engineering geology, rock mechanics, pavements, vehicle mobility, environmental relationships, aquatic weeds, water quality, dredge materials, and excavation. Marine research is conducted mainly in hydraulics, soil mechanics, and environmental research laboratories. In particular, the Hydraulics Laboratory deals with river, tidal, waterwave, and structural hydraulics problems, and carries out basic and applied research, as well as supporting engineering design, through theoretical and mathematical analysis, laboratory and field experimentation, and field measurements.

For further information write to:

Chief of Engineers (DAEN-RDC)
Department of the Army
Washington, D.C. 20314

Defense Documentation Center

The Defense Documentation Center (DDC), a field activity of the Defense Logistics Agency of the Department of Defense, makes available from one central depository thousands of research and development reports produced each year by U.S. military organizations and their contractors. The Center also operates computer-based data banks of management and technical information. *Technical Report Program*. DDC collects, processes, announces, retrieves, and supplies reports of formally recorded technical information in virtually all areas of science and technology. The Center's technical report collection totals more than 1,200,000 titles. About 900,000 of these are under computer control for quick retrieval. More than 2,400 documents which deal with ocean currents are in the report collection; more than 1,500 reports pertain to ocean bottom topography. Every other aspect of oceanography is covered within the collection.

DDC announces the availability of documents it acquires through its own announcement publications and

through announcement media of the Department of Commerce. Newly accessioned classified or limited-distribution documents are announced every other week in the *DDC Technical Abstract Bulletin* and its *Indexes*. Unclassified documents available to the public are processed by the National Technical Information Service and listed in the *Government Reports Announcements and Indexes*.

Organizations registered for DDC services may request copies of the technical reports in either full-size or microfiche. The Center assesses a \$4 service charge for paper copies of technical reports. A charge of 95 cents is made per title for microfiche copies. Reports provided under the Center's Automatic Document Distribution program are supplied at 35 cents each.

Authority to provide a document is determined by the security classification of the report and by any release limitations imposed by the source of the report. Although only registered organizations can obtain documents from DDC, unclassified reports without distribution limitations are available at a fee to anyone through the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

DDC report bibliographies provide selected references in response to specific requests for information relating to actual work problems. A request can be expressed in various ways such as subject matter, organizational sources, contract numbers, personal authors, and any other logical frame of references. Each page of the bibliography contains the descriptive and analytic information on a single page.

No charges are assessed for bibliographies, and users are encouraged to use this service. If a user should receive a bibliography that is not satisfactory, the request should be rephrased and resubmitted.

The *Research and Technology Work Unit Information System* is designed to provide scientists, engineers, and managers in the federal R&D community with an automated rapid retrieval capability for documents of completed research and development; it is also a central source of management and status information on Defense-sponsored R&D in progress.

Essentially, the purpose of the R&T work Unit Information System is to provide the means to determine quickly who is doing what research, when, where, and how. About 25 data fields are used to describe each work unit, the logical segment of an R&D effort chosen by local management for the purposes of technical control. In addition, the summary provides for descriptions of the technical objectives, approaches to be taken, and

the progress made on the various efforts. This information is computer-stored to permit retrieval in a wide variety of logical combinations of the data elements.

The system helps R&D managers identify on-going efforts in any scientific discipline, area, or technology; coordinate current efforts; and determine whether specific areas of endeavor adequately reflect R&D policy guidance. Scientists and engineers may use the system to determine the approach and current status of technical efforts related to their own tasks, to identify scientists and engineers working in areas of similar technical interests, and to periodically review progress statements in pertinent work units.

Data are available to Defense components and other federal agencies, in a variety of formats, such as statistical summaries, tabulations, and complete or partial printouts of selected resumes. Limited access to the data bank is available to contractors and grantees of federal agencies through the use of a single, fixed-format report. Searches of the data bank are free.

The *R&D Program Planning Data Bank*, also operated by DDC, contains descriptions of R&D projects planned by DoD organizations. This information is available only to the Director of Defense Research and Engineering and to other DoD managers for use in reviewing the proposed R&D efforts of Defense organizations. Searches of this data bank are also free.

The *Independent Research and Development (IR&D) Data Bank* contains descriptions of R&D efforts being performed by contractors who are not fully funded by the Department of Defense. The purpose of this collection is to improve communications between Department of Defense scientists and engineers and their counterparts in industrial organizations.

Searches of the IR&D data bank are available to the Director of Defense Research and Engineering, to registered DoD activities, and to certain offices within the National Aeronautics and Space Administration. Searches of this data bank also are free.

DDC operates the *Defense RDT&E On-Line System*, which extends to certain major user organizations the capability of individually querying the four major data banks operated by the Center. These users have direct access to the DDC computers through remote terminals established at their facilities. About 90 remote terminals were operating at the end of 1977.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

The Public Health Service participates in the federal marine science and engineering effort by (1) conducting research aimed at an understanding of factors in the marine environment that have an adverse effect on human health, and investigating the mechanisms through which that toxicity is expressed; (2) using marine organisms as study objects in research to broaden the knowledge base of science underlying medical technology and practice; and (3) making its research findings available and providing technical assistance, training, and consultation to regulatory agencies, industry, and the general public.

At the *National Institutes of Health*, toxic factors in the marine environment are the particular concern of the National Institute of Environmental Health Sciences, with principal laboratories in Research Triangle, North Carolina, and satellite laboratories on Mount Desert Island, Maine, and at Marineland, Florida. Scientists of this Institute, and Institute grantees, are concerned with the effects of pollutants and toxic chemicals on the ecology of rivers, estuaries, and the sea, with particular reference to their potential for causing human disease when affected marine organisms are used as food. Other research fostered by the National Institute of Environmental Health Sciences deals with the health effects of toxins of marine origin, such as those of dinoflagellates and jellyfish.

The use of marine organisms as models for the study of biologic phenomena of general scientific interest pervades the basic science programs of the National Institutes of Health. At least 11 of its 15 research institutes or divisions conduct or support scientific activity in this area. Familiar examples are the use of squid axons in research on the biophysics of transmission of nerve impulses, and of fertilized sea urchin eggs in the study of embryonic differentiation. Less well-known examples are the study of the adhesive properties of barnacles, supported by the National Institute of Dental Research because such research might lead to the development of better dental restorative materials, and the maintenance by the National Cancer Institute of a registry of spontaneously occurring tumors among marine animals. The National Institute of Neurological and Communicative Disorders and Stroke maintains a year-round laboratory at Woods Hole, Massachusetts, for the study of neurophysiological phenomena in marine organisms.

Although terrestrial plants and animals have yielded many valuable medicinal chemicals, among them penicillin, morphine, digitoxin, quinine, insulin, and heparin, the presumed potential of marine organisms as sources of therapeutically useful drugs has not been realized. The National Cancer Institute and the National Institute of Allergy and Infectious Diseases, in particular, sponsor programs of pharmacologic research in which marine species are screened for natural compounds potentially useful in the treatment of disease. Marine organisms may also yield materials which are of practical use as reagents in laboratory science. Examples are keyhole limpet hemocyanin and a lysate prepared from the amoebocytes of the horseshoe crab, both commonly used in the study of infections and immunologic phenomena in higher animals, including humans.

The National Institutes of Health sponsor research in environmental medicine, including projects of particular interest to marine scientists. National Heart, Lung, and Blood Institute grantees are active in research on the physiology of the "diving reflex," and in studies of mammalian pulmonary physiology and gas metabolism under conditions of high pressure. The Institute also sponsors studies of the use of liquids to substitute for gases in breathing, research that raises possibilities of permitting dives to great depths, and investigations of the effects of hydrostatic pressure variations on the functioning of mammalian cells. Both the National Heart, Lung, and Blood Institute and National Institute of General Medical Sciences support research on temperature regulation and thermal adaptation of diving mammals, with potential applications to diving.

The *Food and Drug Administration* (FDA) is responsible for assuring that marine food products shipped in interstate commerce are safe and wholesome and are properly labeled. FDA promulgates appropriate regulations, conducts inspections of marine food processors, examines seafood for contaminants, and supports projects for improving scientific enforcement methods. FDA also develops special seafood control programs with cooperating state control agencies. These activities are based upon the requirements of the Federal Food, Drug and Cosmetic Act, as amended, Public Health Service Act, and Fair Packaging and Labeling Act.

The *National Institute for Occupational Safety and Health* (NIOSH) of the Center for Disease Control (1) is still active on a consulting basis with the Occupational Safety and Health Administration (OSHA) concerning recent promulgated diving regulations, and (2)

is currently preparing a RFP for a contract to study the epidemiology of divers.

For further information write to:

Office of the Chief Engineer, PHS
Parklawn Building, Room 18-42
5600 Fishers Lane
Rockville, Maryland 20857

DEPARTMENT OF THE INTERIOR

The *Bureau of Land Management* has responsibility for administering all surface and subsurface uses, including mineral development, of federal lands not dedicated to specific purposes. As part of that responsibility, the Bureau supports a broad range of marine-related environmental, social, and resource research, mostly through contract, to ensure proper and safe management of the Outer Continental Shelf and the coastal zone. It also maintains data banks for the preparation of environmental impact statements concerning these land areas, as well as in support of other activities related to federal land management.

As part of its mission to examine the geologic structure and the mineral and water resources of the nation, the *U.S. Geological Survey* conducts and supports programs devoted to topographic mapping of coastal lands, to geological and geophysical investigations of the U.S. Continental Margins, and to collecting and interpreting data on the relationships between surface and subsurface waters of the lands and oceans. Information services particularly pertinent to marine science and engineering are provided by the agency's National Cartographic Information Center and Office of Water Data Coordination.

The *Bureau of Mines* conducts supply/demand analysis and mining/metallurgical research on the non-energy metals, minerals, and materials in support of national mineral and mining policy. These functions include mineral resources and their development in the marine environments. Collection and analysis of technical-economic information on ocean mineral resource distribution, quantity, and mineral content, are sponsored by grants and contracts. These data provide input into the Minerals Availability System, a computerized data retrieval system. Oceanographic maps showing seabed mineral resource data are also prepared. The supply/demand studies, other economic analyses, and technology assessment relating to ocean mineral resource

development are conducted by in-house and contract work. Research on the processing of ocean minerals, particularly the seabed metal-bearing nodules, is conducted in Bureau laboratories.

The *Ocean Mining Administration*, established by Departmental Order in 1971, has responsibility for coordination of activities in the Department of the Interior related to mining of the deep seabed beyond the limits of national jurisdiction, and acts as the principal focus of coordination on such matters with other Agencies and Departments; in addition, it serves as a focal point within the Department on matters related to the resources of the Antarctic and the surrounding ocean areas.

The *Bureau of Reclamation* has responsibility for the conservation, development, and use of water and related land resources in the 17 western states, and is involved, in some cases, with marine-related activities of coastal areas in the West.

A more direct role is played by the Department's *Office of Water Research and Technology*, which provides grants through institutes in each state for research on water-related problems, including those in coastal areas. Topics addressed include water supply, augmentation, water-quality maintenance, protection of environment, and integration of land use and water planning. The office operates the Water Resources Science Information Center, a computerized bibliographic information retrieval facility covering the literature in 10 fields of water resources: water properties; water cycle comprising precipitation, evaporation, transpiration, runoff, surface water, soil and groundwater, plant-water processes, erosion, water chemistry, and estuaries; water supply augmentation and conservation; water quantity management and control; water quality management and protection; water resources planning; resources data; engineering works; manpower and grants; and scientific and technical information.

Abstracts of the published literature and derived, reformatted products, and summaries of ongoing water resources research are machine searchable. The abstracts are published twice monthly as *Selected Water Resources Abstracts* (SWRA). The public can purchase publications from NTIS and has access to computer searches of the abstracts base through five network sites.

Requestors may subscribe to the abstract journal, request a computer search of the bibliographic file, and purchase publications (bibliographies and reviews) from NTIS. These services are available free to investigators

on grant or contract to OWRT, State Water Resources Research Institutes, and to federal agencies with water responsibilities and their contractors and grantees.

For further information write to:

Manager
Water Resources Scientific Information Center
U.S. Department of the Interior
Washington, D.C. 20240

The *U.S. Fish and Wildlife Service* has lead responsibility within the Department for the conservation and enhancement of wildlife and "non-marine" gamefish, including all fisheries of the Great Lakes and many species of fish also found in the oceans. It manages the National Wildlife Refuge System, operates fish hatcheries, and conducts research on coastal habitats and ecosystems and on the environmental impact of natural and man-induced phenomena on shoreline and marine birds and mammals, with emphasis on endangered species.

The Department's *National Park Service* conducts and supports marine-related research in both the social and natural sciences to aid in management of coastal areas within the National Park System. These coastal areas offer a range of natural environments for marine investigations supported by others.

As the federal focal point for coordination of outdoor recreation programs, the *Bureau of Outdoor Recreation* supports research to improve these programs. It administers the Land and Water Conservation Fund, which constitutes a source of matching grants to state and local jurisdictions for research in planning and developing marine-related recreational programs and facilities. The *Bureau of Indian Affairs*, through grants to tribal councils and others, supports marine-related research advantageous to Indian interests.

For further information concerning research activities in marine science and engineering within the Department of the Interior write to:

Office of Marine Geology
U.S. Geological Survey
National Center 915
Reston, Virginia 22092

DEPARTMENT OF STATE

Marine-related research conducted by, or under contract to, the Department of State is mainly concerned with economic, legal, political, and social aspects, and consists chiefly of *ad hoc* projects of short duration dealing with timely issues.

The Department also maintains an inventory of government-supported research related to foreign affairs, to which all federal agencies are invited to contribute and which includes marine research as it pertains to foreign affairs.

For further information write to:

Office of External Research
Bureau of Intelligence and Research
U.S. Department of State
Washington, D.C. 20520

DEPARTMENT OF TRANSPORTATION

U.S. Coast Guard

The U.S. Coast Guard's research and development effort is directed to provide research, development, testing and evaluation of equipment, techniques, systems, and materials in support of the myriad operations and regulatory programs of the service. Missions include search and rescue, icebreaking, enforcement of laws and treaties, aids to navigation, commercial vessel safety, marine environmental protection, and recreational boating safety. The productivity and performance for these mission areas includes such activities as the development of pollution spill detection, identification, and quantification methods; new procedures for the control and cleaning of oil and other hazardous substances in the coastal and Arctic regions; testing and evaluation of new marine sanitation devices; advancement of wide-area surveillance systems; and new impact assessment techniques and information systems.

To meet the challenges posed by increased congestion of U.S. ports and waterways, research is being done on systematic identification and analysis of cargo, terminal facility, inspection procedures, and vessel structural and design problem areas; development of a marine safety information system; recreational boating safety education; improvement of port fire fighting equipment and techniques; and technology to minimize the environmental impact of deepwater ports. Continued expansion of marine activity in the coastal zone and

polar regions has led to increased efforts to develop sophisticated surveillance methods and equipment to protect offshore resources, to enforce pollution and fisheries laws, to provide more effective search and rescue assistance, to facilitate waterborne transportation, and to support the regional national security needs.

In the area of aids to navigation and ocean operations, research is directed toward improved methods for positioning aids, a precision all-weather Loran-C navigation capability, system standards for audio-visual aids, development of solar energy for aids to navigation, and continued refinement of icebreaking techniques and facilities.

In addition to these direct operating program support activities, long-range projects include technology forecasting for underwater activity, feasibility studies of unmanned vehicles and underwater sensing, and development of vehicles and marine transportation requiring low energy use.

For further information write to:

Chief, Planning and Evaluation Staff
Office of Research and Development
U.S. Coast Guard
Washington, D.C. 20590

DEPARTMENT OF ENERGY

In order to gain an understanding of the coastal zone environment as a complete system, the Department of Energy in 1975 (as the Energy Research and Development Administration) began supporting long-term research programs covering six geographic areas: the Southeast, the Northeast (Mid-Atlantic Bight), Pacific Northwest, Gulf of Mexico, the California Coast, and the Great Lakes. All of these programs with the exception of the Gulf Coast are underway. In addition operational programs in support of the recolonization of the Marshall Islands are carried out in the Pacific. Research activities include the following:

Distribution and dispersion of trace metals from rivers through estuaries and onto the continental shelf and effects of air pollutants on coastal ecosystems.

Processes that trigger the production of microscopic plant life, which is the first step in the food chain, in order to assess potential effects of energy developments.

Influence of the Gulf Stream and winds on current patterns to determine the transfer of pollutants and nutrients along the continental shelf.

Movement of plutonium and tritium in coastal waters and resulting concentrations in marine life, and developments of a computer model to help predict future effects of energy development.

Microbial, invertebrate, and fish populations, and the movement of trace elements and radionuclides in the estuaries and coastal waters near Beaufort, North Carolina.

Basic biological processes that affect the survival of plant and animal communities on the continental shelf to assess effects of oil spills and releases from power plants on these processes.

In addition the Department's Division of Solar Energy is working on marine-related energy conversion technology, particularly ocean thermal energy conversion (OTEC) to harness thermal gradients between surface and deep ocean water. As part of the OTEC program, heat exchangers are being developed at laboratory and bench scales preliminary to ocean testing. For bioconversion, experiments in kelp mariculture are underway; in wind energy conversion, studies of offshore windmills are beginning; and technological assessment of other ocean energy options is in process, especially as related to waves, tides, and salinity gradients.

For further information write to:

Marine Science Program
Environmental Programs
Division of Biomedical and
Environmental Research
U.S. Department of Energy
Washington, D.C. 20545

The Department of Energy/Fossil Energy programs relative to Marine Research are or have been:

The Seafloor Earthquake Measurement System (SEMS) will be used to reliably and cost-effectively gather earthquake information in the seismically active areas of the Outer Continental Shelf (OCS). Improvements on the state-of-the-art will include ease of installation and data retrieval, remote operations and long life (Sandia Labs).

The "OCS Analytical Model" represents the processes involved in developing the oil and gas reserves of the Outer Continental Shelf (SDC/MRI).

The three volume "Offshore Data Sources and Contents" identifies data sources and data base contents relevant to offshore oil and gas development (exploration, development, production, transportation and on-shore impact) (SDC/MRI).

The "Users and Users' Information" identifies the user and users' need for information relevant to frontier offshore oil and gas resource development (SDC/MRI).

The "Acceleration of Outer Continental Shelf (OCS) Oil and Gas Development" tested a data base system for the scientific analysis and display of environmental data (GURC).

ENVIRONMENTAL PROTECTION AGENCY

The marine research program of the Environmental Protection Agency provides the data base essential to developing guidelines, water quality standards, pesticide registration, ocean discharge criteria, and effluent standards for toxic and hazardous materials. The scientific validity of the Agency's criteria and standards is essential. Unreasonably stringent environmental quality standards would place an intolerable economic burden upon municipalities and industries but inadequately protective standards would permit environmental degradation.

Marine research activities are conducted at three laboratories located in Corvallis, Oregon; Narragansett, Rhode Island; and Gulf Breeze, Florida. Emphasis is given to research on ocean disposal (dumping and outfalls), petroleum and petroleum products, pesticides, carcinogens, thermal pollution, anti-fouling agents and disinfection, complex wastes, and ecosystems dynamics.

Research at the Corvallis Environmental Research Laboratory is directed toward ocean outfall discharges and non-point source pollutants. The objectives of this research include the development of assessment techniques and methods, the determination of ecosystem effects, and the development of the scientific base necessary to regulate ocean outfall and non-point discharges for optimal ecosystem protection. Mathematical and simulation modeling for predicting pollutant dynamics and the potential for ecosystem alterations is an integral part of this research effort. Other research involves wetlands and determination of the relative "health" of marine ecosystems.

Research at the Narragansett Environmental Research Laboratory responds directly to a legislative mandate to develop marine water quality criteria as a defensible decision base for setting and enforcing marine water quality standards. Additional research seeks to assess the environmental impact of ocean dumping of materials such as dredge spoils, sewage sludge, and industrial wastes. Other programs examine the effects of petroleum and petroleum products discharged into the marine environment, and the risks associated with exposure to pollutants.

At the Gulf Breeze Environmental Research Laboratory research is conducted on the ecological effects of pesticides and other synthetic organic compounds on marine and estuarine organisms and ecosystems. Studies are also conducted to determine the pathways, biological effects, and fate of hazardous organic and inorganic pollutants in estuarine ecosystems, simulated as well as *in natura*. Research concerned with the effects of toxicants on marine and estuarine species at the cellular, tissue, organism, and ecosystem level is ongoing and integrated into the overall research effort. Research is also conducted on dredge materials and disinfection.

The recently established Environmental Research Information Center, Cincinnati, is the central contact point for obtaining research information including Technology Transfer publications. ERIC's active information transfer program interprets the specific needs of the different user groups and develops separate information products tailored for particular target audiences. Transference occurs through the media of seminars, conferences, symposia, newsletters, and executive briefings. All publications are listed in the EPA ORD Publication Summary, EPA 600/2/76/013d, December 1976 and in the EPA Publications Bibliography Quarterly Abstract Bulletin, NTIS, Springfield, Virginia.

For further information concerning ongoing research write to:

Office of Research and Development, RD-683
U.S. Environmental Protection Agency
Washington, D.C. 20460

To obtain technical information publications, write to:

Environmental Research Information Center
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA, through its Office of Applications, supports oceanography related research efforts leading to the demonstration of applying aerospace technology and visible, infrared, and microwave remote sensing techniques to repetitive synoptic observations and measurements of ocean conditions and the quality of the marine environment on a global basis. To ensure that these activities are responsive to the needs or desires of other federal agencies for new or improved ocean data and information acquisition systems, the Office of Applications maintains a close cooperative working arrangement with those agencies during research planning, implementation, and assessment of accomplishments. To date, efforts have culminated in successful oceanography remote sensing experiments of NASA's series of Nimbus, Landsats-1, GEOS-3, Apollo, and Skylab orbital space flight missions. These experiments have demonstrated the utility of visible and infrared remote sensing techniques in providing information on circulation patterns, currents, sediment transport, pollutants, bioproductivity, sea ice conditions, and sea surface topography associated with sea mounts or deep ocean trenches. Emphasis is now being placed on the development and field testing of passive and active microwave remote sensors and a multispectral visible and near-infrared scanner to be used on Seasat-A and Nimbus-G respectively, which are to be launched during 1978. Seasat-T, the first in a series of Ocean Dynamics Satellites, will be placed in a nearly polar orbit to permit the acquisition of data relative to sea state, sea surface topography, wave directional spectra, sea surface wind speed and direction, ocean currents, ice cover, and geoidal variations every 36 hours. Investigations will be conducted to assess the utility of the Nimbus-G ocean color scanner for detecting, identifying, mapping, and quantifying ocean pollution, nutrient rich areas related to fisheries, coastal zone circulation patterns, and shoreline alterations.

For further information write to:

Deputy Associate Administrator
for Applications
National Aeronautics and Space Administration
Washington, D.C. 20546

NASA's *Scientific and Technical Information Facility*, which is located adjacent to the Baltimore-Washington International Airport, collects the results of worldwide aerospace research and development. Major services include literature searches, bibliographies, distribution of documents, access to Department of Defense and Department of Energy data bases and to many additional scientific and technical data bases, and selective notification of new information and ongoing research.

NATIONAL SCIENCE FOUNDATION

The Division of Ocean Sciences of the National Science Foundation supports two research programs and a third program for acquisition and operation of research facilities.

Oceanography Project Support provides grants for developing fundamental knowledge about the oceans, primarily for studies in physical and biological oceanography, submarine geology and geophysics, and marine chemistry.

The *International Decade of Ocean Exploration* supports large-scale international investigations of the role of the ocean as related to climate, food production, pollution, energy, and natural resources. Four projects are incorporated in this program: (1) Environmental Forecasting, which is aimed at improved environmental prediction through better understanding of climate changes, the influence of the oceans on the atmosphere, and the part played by ocean circulation in shaping weather and climate; (2) Environmental Quality, which deals with the impact of man-made chemicals on the marine environment through study of the effects of pollutants on marine organisms, transfer of pollutants to the marine environment, and the worldwide distribution of geochemical features of ocean waters; (3) Seabed Assessment, which supports studies of the natural processes that result in formation and distribution of metal-rich manganese nodules, petroleum, and gas; and (4) Living Resources, which sponsors basic research in ocean processes that affect the development of living marine resources.

The *Oceanographic Facilities and Support* program provides major support for 30 research ships and several facilities operated by 15 academic oceanographic laboratories. The continuing objectives of this program are to maintain, improve, and effectively

manage a cooperative system of oceanographic facilities at key locations in the academic community, and promote their shared use through the University National Oceanographic Laboratory System (UNOLS), an organization within that community.

Other divisions within the Foundation also sponsor projects relating to the marine environment, including research in ocean engineering, marine resource management, and the influence of the oceans on weather and climate.

For further information write to:

Office of the Assistant Director for Astronomical,
Atmospheric, Earth, and Ocean Sciences
National Science Foundation
Washington, D.C. 20550

SMITHSONIAN INSTITUTION

The Smithsonian Institution's *Museum of Natural History* maintains the largest collection of biological specimens and geological samples in the world, an important resource for research on current and historical environmental conditions. An example of research projects carried out under the auspices of the Museum is Investigations of Marine Shallow Water Ecosystems, a study of the physical, chemical, and biological aspects of an undisturbed reef adjacent to Belize, British Honduras, which can be used as a baseline for comparison with polluted or otherwise disturbed reef systems.

Other activities in marine science include the following:

Scientific Event Alert Network, established in 1975 to serve as a clearinghouse for information on transient, biological, astronomical, and geological events.

Smithsonian Oceanographic Sorting Center, which receives, sorts, records, and curates aquatic collections, makes specimens available to specialists, and maintains a data bank on the collections.

Chesapeake Bay Center for Environmental Studies, a long-term ecosystem study of the Rhode River estuary and watershed located on the western shore of Chesapeake Bay.

Smithsonian Tropical Research Institute, located in Panama, which is concerned with basic scientific questions of the evolutionary and ecological adaptations of tropical organisms.

Fort Pierce Bureau, located at Link Port on the Indian River between Fort Pierce and Vero Beach, Florida, where studies include a baseline survey of the Indian River, life history investigations of marine animals, and development of rescue systems for small research submarines.

For further information write to:

Assistant to the Director
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560

ACCESS TO MARINE SCIENTIFIC AND TECHNICAL DATA AND INFORMATION

CURRENT RESEARCH INFORMATION

Smithsonian Science Information Exchange, Inc.

The Smithsonian Science Information Exchange, Inc. (SSIE), a nonprofit corporation of the Smithsonian Institution located in Washington, D.C., was established in 1949 by six federal agencies engaged in the sponsorship and performance of research in the medical sciences. Over the years SSIE has expanded both the scope of its coverage and the extent of its services. Today the Exchange receives project information from over 1,300 organizations that sponsor research, including federal, state, and local government agencies; nonprofit associations and foundations; colleges and universities; and, to a limited extent, foreign research organizations and private industry. The active search file, which covers the two most recent fiscal years, now contains more than 200,000 descriptions of ongoing or recently terminated projects in all fields of science; nearly 6,000 of these are in marine science and engineering and closely related fields.

The basic record in the SSIE system is the single-page Notice of Research Project (NRP), which contains the data elements essential to most users of the file: supporting organization name and control, grant, or contract number; performing organization name and address; investigator name(s); project title; period for the description; and a 200-word technical summary of the work to be performed. In some cases, funding information is also included.

To meet a variety of user needs, the Exchange has developed a wide range of information products and services.

Custom Searches. In response to individual requests, staff scientists search the active file for NRP's on specific subjects. Searches for NRP's from particular performing organizations or departments, for geographic areas, or for any combination of similar requirements can also be made. The fee for this service is \$60.00 for the search and the first 50 NRP's sent, plus \$0.25 for each additional NRP. Estimates of coverage and costs for specific custom searches are available without charge.

Selective Dissemination of Information (SDI). The Exchange offers two types of SDI service for users who wish to receive regular updates of custom searches or research information packages (see below). SSIE scientists establish a user interest profile for each SDI subscriber; then periodic searches of the active file are conducted against this search profile to identify all new or newly updated project notices added to the data base since a previous search was made.

Subscribers to *Standard SDI Service* receive 12 monthly search updates, compiled automatically by computer, for a single fee of \$180.00. *Custom SDI Service* provides subscribers with quarterly updates, each of which is carefully reviewed by a staff scientist to assure maximum relevance of update contents to search profile requirements. The quarterly cost of Custom SDI Service is \$50.00 for the search service and the first 1 to 50 NRP's, plus \$0.25 for each additional NRP.

Investigator or Accession Number Searches. Searches of the active file can be performed by principal or co-investigator name (\$2.00 per name), or by SSIE accession or agency control number (\$1.00 per number). Minimum order: \$10.00.

SDC/SSIE On-Line Search Service. The SSIE data base is available on-line for users with access to a computer terminal who wish to search the file directly. Further information about this service can be obtained from System Development Corporation (SDC) at 2500 Colorado Avenue, Santa Monica, California 90406, or 7929 Westpark Drive, McLean, Virginia 22101.

Aids developed by SDC and SSIE to assist on-line users in conducting searches through the SDC system include manuals describing SDC's retrieval program applications, a guide to the SSIE subject indexing system, and a three-volume computer printout of over 90,000

SSIE Subject Terms and Synonyms. This printout has proven useful not only in querying the SSIE file, but also in designing subject search strategies for other data bases.

Research Information Packages. SSIE scientists regularly conduct and review searches of the active file for NRP's on topics of high current interest. The results of these searches are compiled into research information packages which, once established, are available at costs that represent significant savings over those for custom searches. Package contents are updated every 90 days.

Prices vary according to the average annual number of NRP's expected to be included. Because the contents of the data base fluctuate, packages compiled at different times during the year may contain NRP counts outside the range indicated by their published price.

Packages priced at \$35 contain up to 25 NRP's; those at \$45, 26-100 NRP's; at \$55, 101-200 NRP's; and so on.

Research information packages now available in marine science and engineering include the following:

Oceanography

LO01L	Oceanographic acoustics and applications: Acoustical characteristics of seawater and marine sediments, sonar and sofar, bioacoustics	\$65
LO02L	Use of buoys for oceanographic data collection	\$55
LO03L	Bathymetric mapping	\$45
LO04L	Igneous and metamorphic rocks on the sea-floor	\$45
LO05L	Coastal zone management	\$55
LO06L	Seismic profile systems in oceanography	\$45
LO08L	Ocean drilling and core analysis	\$55
LO10L	Metals and trace elements in seawater and marine sediments	\$45
LO12L	Sea ice	\$45
LO15L	Ocean sediment types	\$45
LO16L	Ocean sediment properties	\$55
LO17L	Ocean topography	\$55
LO18L	Ocean turbidity and turbidity currents	\$45
LO19L	Ocean thermal properties	\$55
LO20L	Use of bathythermographs	\$35
LO21L	Continental shelves and slopes, continental margins	\$55
LO22L	Oceanographic magnetics	\$45
LO23L	Remote sensing of the ocean surface: Detection and identification of water pollutants,	

water temperature, heat flow, sea-air interaction, ocean current dynamics \$55

LO24L Oceanographic gravity \$45

LB13L Energy derivation from the ocean's thermal structure \$45

LM09L Ocean mining \$55

(NOTE: Contains material in LM25L.)

LM25L Offshore oil and gas \$45

LT09L Sand dunes \$35

LT16L Coastal erosion \$45

AW17L Drugs from the sea \$45

CA05L Social impacts and public involvement in marine environment development \$45

FQ02L Underwater photography \$35

GT11L Use of submersibles for underwater research \$35

IB32L Wind power, tidal and sea wave power, power from ocean currents and gradients \$55

(NOTE: Contains material in LB13L.)

IQ02L Underwater acoustics: Transmission and attenuation characteristics of fresh- and sea-water, underwater imaging and detection \$35

IZ03L Underwater optics: Transmission, scattering, and optical properties of fresh- and sea-water; underwater surveillance; optical source development \$45

JJ05L Marine and underwater communication systems (excludes sonar) \$45

KC53L Computer usage in oceanography \$45

Marine and Naval Engineering and Operations

GA94L Ship and marine noise and vibrations \$45

GJ01L Coastal engineering: Breakwaters, ports, harbors, piles, and other coastal structures \$55

GJ05L Dikes and levees \$45

GJ06L Offshore structures: Bottom-supported and floating platforms \$45

GK05L Submarine soil mechanics \$45

GK14L Deep foundations: Caissons, piers, and pile foundations \$45

GT02L Ship hulls, submarine hulls, hull foams, and hull-like structures \$45

GT03L Marine anchors and mooring systems \$45

GT06L Marine and ship propellers \$45

GT07L Ship models and simulators \$45

GT08L Submarines: Design, construction, hydrodynamics, structural components, dynamic responses, stability and control \$55

(NOTE: Contains material in GT11L.)

GT09L	Ship motion and stabilities: Gyration, roll, dynamic responses, performance, maneuverability \$55
GT11L	Use of submersibles for underwater research \$35
GU01L	Antisubmarine warfare \$55
GU11L	Torpedoes \$45
GU12L	Naval logistics \$45
GV05L	Underwater construction \$35
HM03L	Marine corrosion and fouling \$45
HT11L	Wood preservation \$45
JJ05L	Marine and underwater communication systems (excludes sonar) \$45
JQ02L	Navigational and landing aids: Autopilots, beacons, direction finders, compasses \$45
JQ05L	Sonar and echo sounding systems \$55
JQ07L	Satellite and space navigation systems \$35
JQ08L	Radio navigation systems \$35
JQ09L	Marine, ship, and underwater navigation systems \$35
JQ10L	Position location systems \$45
LT11L	Scouring in streams, estuaries, and coastal zones \$45
LT16L	Coastal erosion \$45

Meteorology

LR03L	Tropical cyclones: Hurricanes and typhoons \$45
LR14L	Atmospheric radiation balance and heat exchange \$55
LR18L	Weather sensing by rockets and satellites \$55
LR19L	Wind velocity \$45

Environmental Quality

BA29L	Bioenvironmental effects of electric power plants \$75 (NOTE: Contains material in BA52L.)
BA42L	Microbial degradation of petroleum and other hydrocarbons \$45
BA51L	Pollution of coral reefs \$35
CA05L	Social impacts and public involvement in marine environment development \$45
FA05L	Oil pollution cleanup: Analysis, separation, and removal of oil from sources such as oil spills and industrial wastes \$45 (NOTE: Contains material in BA42L.)
FA14L	Lead as a pollutant: Analysis and removal of lead from air, water, or wastes; sources of the pollutant \$55

- FA35L Sewage sludge disposal methods: Burial, incineration, landfills, ocean dumping \$55
 - GA47L Dredging and dredged materials \$45
 - IV13L Nuclear waste management \$55
 - LA30L Marine disposal and dumping of sewage, ship wastes, industrial and other solid wastes \$45
 - LA38L Natural disasters: Floods, earthquakes, avalanches, landslides, tsunamis, volcanic eruptions \$85
 - LA75L Environmental baseline measurements for power plant siting \$55
 - LA76L Environmental standards and impact statements for power plants \$45
 - LA79L Impact of electric power plants on the environment \$75
- (NOTE: Contains material in BA29L, BA33L, BA52L, LA16L, LA76L.)

Water Quality

- LA04L Eutrophication of lakes, streams, reservoirs, and coastal waters; eutrophication control \$65
 - LA13L Turbidity in oceans, bays, streams, and lakes \$55
 - LA15L Effects of dredging on freshwater and marine environments \$45
 - LA16L Thermal water pollution: Heated water discharges from power plants into natural waters \$65
- (NOTE: Contains material in BA33L.)
- LA30L Marine disposal and dumping of sewage, ship wastes, industrial and other solid wastes \$45
 - LA31L Water pollution in estuarine and coastal zones: Identification, effects, and control of pollutants \$95
 - LA32L Oil pollution in the marine environment: Detection, effects, treatment \$65
 - LA37L Oil spill monitoring \$35
 - LA44L Monitoring and analysis of marine pollution \$45
 - LA72L Carriage and transport of pollutants by elements of the hydrologic cycle \$95
 - LA82L Water quality in harbors and ports \$45
 - BA05L Shellfish as bioindicators of pollution \$35
 - BA06L Toxic and ecologic effects of petroleum and crude oil on animals, plants, and humans; biodegradation of petroleum pollutants and toxicity of petroleum \$55 (NOTE: Contains material in BA42L, LA32L.)

BA19L	Algal population growth and eutrophication of marine and freshwater systems \$55 (NOTE: Contains material in BA40L.)
BA21L	Diatoms and other algae as indicators of water quality \$45
BA33L	Ecological effects of thermal pollution: Mixing and dispersion of thermally enriched waters, waste heat utilization \$55
BA35L	Tidal marshes: Ecological surveys, management, and pollution effects for marine, estuarine, and salt marshes \$45
BA37L	Bacterial pollution of water \$55
BA39L	Management of coastal and estuarine development with respect to water quality \$45
BA42L	Microbial degradation of petroleum and other hydrocarbons \$45
BQ11L	Effects of fisheries and seafood processing on water quality \$45
FA07L	Wastes from food processing: Treatment, disposal, and reclamation of food processing wastes by chemical, physical, and biological methods \$55
FA12L	Determination of organic substances in natural water: Detection and analysis of pesticides, oil, hydrocarbons \$55
FA13L	Mercury as a water pollutant: Analytical techniques for the detection of mercury levels in fish and water, physiological effects on fish, potential as a human health hazard \$55
FA16L	Petroleum refinery and petrochemical industrial wastewater treatment and disposal \$45
FA28L	Viruses in water: Detection, monitoring, and removal \$45

Environment and Ecology

BA01L	Chlorophyceae and Charophyceae (green algae) \$55
BA02L	Diatoms \$45
BA04L	Marine fouling organisms \$45
BA05L	Shellfish as bioindicators of pollution \$35
BA06L	Toxic and ecologic effects of petroleum and crude oil on animals, plants, and humans; biodegradation of petroleum pollutants and toxicity of petroleum dispersant chemicals \$55 (NOTE: Contains material in BA42L, LA32L.)
BA07L	Aquatic species diversity measurements \$45
BA08L	Starfish \$35
BA10L	Cetacea \$45

BA11L	Computer modeling of marine biological populations \$45
BA12L	Bacterial slime \$45
BA17L	Biological effects of zinc or boron pollution \$45
BA19L	Algal population growth and eutrophication of marine and freshwater systems \$55 (NOTE: Contains material in BA40L.)
BA20L	Effects of light quantity and quality on aquatic algae \$45
BA21L	Diatoms and other algae as indicators of water quality \$45
BA22L	Cyanophyta (blue-green algae) \$55
BA23L	Euglenophyta \$45
BA24L	Kelps \$35
BA25L	Dinoflagellates \$45
BA28L	Red Tides \$35
BA29L	Bioenvironmental effects of electric power plants \$75 (NOTE: Contains material in BA52L.)
BA33L	Ecological effects of thermal pollution: Mixing and dispersion of thermally enriched waters, waste heat utilization \$55
BA35L	Tidal marshes: Ecological surveys, management, and pollution effects for marine, estuarine, and salt marshes \$45
BA37L	Bacterial pollution of water \$55
BA39L	Management of coastal and estuarine development with respect to water quality \$45
BA40L	Primary productivity of phytoplankton \$45
BA42L	Microbial degradation of petroleum and other hydrocarbons \$45
BA45L	Marine food chains and environmental relationships \$45
BA46L	Vertical distribution of marine plankton in relationship to acoustic properties of water \$35
BA50L	Detection of enteric viruses in the environment \$35
BA51L	Pollution of coral reefs \$35
BA52L	Impingement, entrainment, or entrapment of aquatic organisms by water intake structures of power plants \$35
BJ18L	Sea urchins \$45
BJ38L	Biotransformation of mercury by microorganisms in aquatic sediments: Methylation, effects, mercury cycling in aquatic environments \$45

Fish and Wildlife

BA05L	Shellfish as bioindications of pollution	\$35
BA06L	Toxic and ecologic effects of petroleum and crude oil on animals, plants, and humans; biodegradation of petroleum pollutants and toxicity of petroleum dispersant chemicals	\$55 (NOTE: Contains material in BA42L, LA32L.)
BA08L	Starfish	\$35
BA10L	Cetacea	\$45
BA11L	Computer modeling of marine biological populations	\$45
BA35L	Tidal marshes: Ecological surveys, management, and pollution effects for marine, estuarine, and salt marshes	\$45
BA37L	Bacterial pollution of water	\$55
BA45L	Marine food chains and environmental relationships	\$45
BP20L	Thermal tolerance and acclimatization in fish	\$35
BP21L	Osmoregulation in aquatic vertebrates	\$45
BQ03L	Coho salmon	\$45
BQ06L	Economics of aquaculture	\$45
BQ07L	Shellfish pathology	\$45
BQ08L	Fish spawning sites: Nursery areas, artificial beds, rehabilitation of suitable natural areas, physical properties of sites	\$55
BQ11L	Effects of fisheries and seafood processing on water quality	\$45
BQ15L	Legislative, administrative, and sociocultural influences on the management of marine commercial fisheries	\$45
BQ17L	Marine and estuarine aquaculture	\$45 (NOTE: Contains material in BQ26L.)
BQ18L	Sonic tagging of fish	\$35
BQ26L	Role of algae in aquaculture	\$35
BQ27L	Marine mammals	\$55 (NOTE: Contains material in BA10L.)
EQ05L	Control of undesired fish by chemical, biological, cultural, or physical means	\$45
EQ12L	Waterfowl censusing	\$35
EQ15L	Creel censusing of fish	\$45
EQ16L	Nesting sites of waterfowl including use of artificial nests	\$35

Recreation

AA06L	Effects of water pollution on utilization of outdoor recreation sites by the public	\$45
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- AO18L Diving physiology and pathology \$55
(NOTE: Contains material in AO23L.)
- AO23L Physiological and pathological aspects of hyperbaric oxygen \$45
- ER03L Commercial sport fishing or hunting of game birds or large game animals \$45
- ER04L Relationship between water quality and recreational use \$55
- ER10L Water-based recreation, including fishing \$55
(NOTE: Contains material in ER18L.)
- ER18L Water sports: Swimming, boating, water skiing, and scuba diving \$45

For further information write to:

Smithsonian Science
Information Exchange, Inc.
Room 300, 1730 M Street, N.W.
Washington, D.C. 20036

ENVIRONMENTAL DATA AND INFORMATION

National Technical Information Service (NTIS)

The National Technical Information Service is the central source for the public sale of government-sponsored research, development, and engineering reports and other analyses prepared by federal agencies, their contractors or grantees, or by special technology groups. It is also a central source for federally generated machine-processable data files. The information collection exceeds 1 million titles and all are available for sale. About 105,000 titles are stocked in multiple copies. Current lists of best selling reports describe those most in demand.

NTIS announces some 1,500 new reports each year on marine engineering, including harbors, port facilities and marine navigation; dynamic oceanography; physical and chemical oceanography; biological oceanography; marine geophysics and geology; oceanographic vessels, instruments; platforms and underwater research vehicles; hydrography; and underwater construction and habitats.

Customers can quickly locate summaries of interests from among 480,000 federally sponsored research reports completed and published from 1964 to date by using the agency's on-line computer search service, NTI Search, or by referring to more than 1,000 Published Searches. About 60,000 new summaries and reports are

added annually. Copies of the whole research reports on which the summaries are based are sold by NTIS in paper or microform.

The NTIS Bibliographic Data File, on magnetic tape, includes unpublished research summaries and is available for lease. The computer products of other federal agencies are sold or leased by NTIS.

Current summaries of new research reports and other specialized information in various categories of interest are published in some 26 weekly, indexed newsletters, including one entitled *Ocean Technology*. An all-inclusive biweekly journal, *Government Reports Announcements & Index*, is published for librarians, technical information specialists, and those requiring all the summaries in a single volume.

A standing order microfiche service (SRIM) automatically provides subscribers with the full texts of research reports especially selected to satisfy individual requirements. Automatic distribution of paperbound reports is also available.

The above and additional information products and services are described in the free NTIS general catalog (PR-154).

For further information write to:

National Technical Information Service
U.S. Department of Commerce
Information Center & Bookstore
425 - 13th Street, N.W.
Washington, D.C. 20004

Oceanic and Atmospheric Scientific Information System (OASIS)

The Environmental Science Information Center of NOAA's Environmental Data and Information Service offers automated literature searches through the Oceanic and Atmospheric Scientific Information System (OASIS) to both NOAA and non-NOAA users. OASIS allows computerized access to some 11 million references to published scientific and technical information. The more than 40 data bases that make up OASIS can be searched for any subject in the atmospheric, marine, and earth sciences. Among data bases pertinent to marine science and technology are Aquaculture, Bibliography and Index of Geology, Engineering Index Compendex, The Fish and Wildlife Reference Service, Meteorological and Geostrophysical Abstracts, Oceanic Abstracts, Petroleum Abstracts, Pollution, Selected Water Resources Abstracts, Enviroline, Aquatic Sci-

ences and Fisheries Abstracts, Biological Abstracts, and Petroleum Abstracts.

For further information write to:

Users Services Branch
Library and Information Services Division
Environmental Science Information Center
Environmental Data and Information Service
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

Environmental Data Index (ENDEX)

Developed by NOAA's Environmental Data and Information Service, the Environmental Data Index (ENDEX) contains computer-searchable descriptions of interdisciplinary files of environmental data on many levels. ENDEX has three major components: (1) descriptions of data collection efforts, (2) descriptions of data files, and (3) detailed inventories of large, commonly used files. The data file description lists the types of parameters and volumes of data available; methods of measurements; when and where the data were collected; sensors and platforms used; data formats; restrictions on data availability; publications in which the data can be found; whom to contact for further information; and estimated cost of obtaining the data.

ENDEX services and products include the following: (1) access to specialized indexes of environmental data, grouped by geographic areas, institutions, or disciplines; (2) on-line, interactive searches of indexes to answer specific questions concerning the availability and whereabouts of data files; (3) quick-response determination of the costs of retrieval from large data files; and (4) data catalogs from large NOAA environmental data collection projects. Individual ENDEX data files descriptions are updated every 2 years.

For further information write to:

Data Index Branch
National Oceanographic Data Center
Environmental Data and Information Service
National Oceanic and Atmospheric Administration
Washington, D.C. 20235

Regional Coastal Information Centers (RCIC)

The Regional Coastal Information Center (RCIC) concept is a new approach to making coastal and marine

information and data locally available to those who need it. There is a growing constituency for such services, particularly as more and more of the management of coastal resources is being undertaken by state and local governments.

The RCIC program is sponsored jointly by three NOAA components: the Marine Advisory Service, Environmental Data and Information Service, and Office of Coastal Zone Management.

Working on a regional basis, the RCIC can identify resources that relate to the coastal and marine environment of the region, whether resources are academic, private, industrial, or governmental, and whether held locally, regionally, or nationally. Users are able to request materials or referral to resources within the region and throughout the country.

At present, three RCICs are operational: the Northeast RCIC located at the University of Rhode Island in Narragansett; the Northwest RCIC located jointly at the University of Washington in Seattle and Oregon State University in Corvallis; and the Great Lakes RCIC located jointly at the University of Michigan and Great Lakes Basin Commission in Ann Arbor. Eventually there will be nine RCICs, covering all U.S. coastal zone regions, including Alaska and Hawaii.

For further information write to:

Mr. Robert Shephard

Office of Sea Grant

National Oceanic and Atmospheric Administration
Washington, D.C. 20235

EDIS Data Centers

The Environmental Data and Information Service (EDIS), NOAA, was specifically created to manage environmental data. Of the six EDIS centers, three maintain collections and provide services related to marine science and technology.

The *National Oceanographic Data Center* (NODC) disseminates oceanographic data, develops analytical and descriptive products to meet user requirements, and provides facilities for the World Data Center-A (Oceanography). Oceanographic data available from NODC include: mechanical and expendable bathythermograph data in analog and digital form; oceanographic station data for surface and serial depths, giving values of temperature, salinity, oxygen, inorganic phosphate, total phosphorus, nitrite-nitrogen, silicate-silicon, and pH;

continuously recorded salinity-temperature-depth data in digital form; surface current information obtained with drift bottles or calculated from ship set or drift; and biological data, giving values of plankton standing crop, chlorophyll concentrations, and rates of primary productivity.

For further information write to:

National Oceanographic Data Center
Environmental Data and Information Service
National Oceanic and Atmospheric Administration
Washington, D.C. 20235

The *National Climatic Center* (NCC) in addition to being the custodian of all United States weather records, is also the repository for data collected during large-scale investigations of the air-sea interface. Such special collections include data from the International Field Year for the Great Lakes (IFYGL), a 1972-73 field study of the physical, chemical, and biological processes of Lake Ontario; from the Barbados Oceanographic and Meteorological Experiment (BOMEX), conducted in 1969; and from the GARP (Global Atmospheric Research Program) Atlantic Tropical Experiment (GATE), a multinational experiment conducted in the eastern Atlantic in the summer of 1974.

For further information write to:

National Climatic Center
Environmental Data and Information Service
National Oceanic and Atmospheric Administration
Federal Building
Asheville, North Carolina 28801

Environmental and earth resources satellite data, including both visible light imagery and infrared data are available from NCC's Satellite Data Services Branch.

For further information write to:

Satellite Data Services Branch
World Weather Building, Room 606
Washington, D.C. 20233

The *National Geophysical and Solar-Terrestrial Data Center* (NGSDC) disseminates solid earth and marine geophysical data, including bathymetric measurements; seismic profiles; gravimetric measurements; geomagnetic total field measurements, and geological data on heat flows, cores, samples, and sediments.

For further information write to:

National Geophysical and
Solar-Terrestrial Data Center
National Oceanic and Atmospheric Administration
Boulder, Colorado 80302

NON-GOVERNMENT SOURCES OF INFORMATION

The *Information Industry Association* (IIA) is made up of over 100 companies offering information products, services, and systems in specific subjects. More than 150 data bases are available. Information companies serve a particular market function or subject area, such as manufacturing data bases, distributing information, performing specialized searches, and providing information for problem-solving. For a description on subject specialties in the membership directory, *Information Sources*, write to:

Information Industry Association
4720 Montgomery Lane
Bethesda, Maryland 20014

Lockheed Information Services operates DIALOG, an online information system. Over 70 data bases include bibliographies, conference proceedings, descriptions of current research, directories, periodicals, and reports in all major disciplines. Among the data bases listed are Aquatic Sciences and Fisheries Abstracts, Oceanic Abstracts, and Pollution Abstracts. The Selective Dissemination of Information (SDI) searches are being expanded.

For information write to:

Lockheed Information Systems
DIALOG Marketing, Dept. 50-20/201
3251 Hanover Street
Palo Alto, California 94304

The *Raytheon Service Company* (RSC), a wholly owned subsidiary of the Raytheon Company, operates clearing houses, information retrieval systems, and related information-management services on engineering and technical services worldwide. It provides printing services, audio-visual materials, and technical studies. Technical Information Services handle complete library

services, including translations and abstracts in 13 languages.

For information write to:

Raytheon Service Company
Spencer Laboratory
2 Wayside Road
P.O. Box 503
Burlington, Massachusetts 01803

The Departments of Energy and Industry of the United Kingdom are supporting the *Marine Information and Advisory Service* (MIAS), which incorporates the former British Oceanographic Data Service, at the Institute of Oceanographic Science (IOS). MIAS is to assist government and industry with requests for oceanographic data. The "Marine Information and Advisory Service Leaflet" and the "MIAS Introductory User Guide," both produced by the IOS, describe the variety of products to be available from the computerized data bank.

For more information write to:

MIAS Enquiry Desk
Institute of Oceanographic Services
Brook Road
Wormley, Godalming, Surrey
HU8 5UB ENGLAND

SUBJECT TERMS FOR ACCESS TO FEDERAL MARINE SCIENCE AND ENGINEERING PROJECT INFORMATION

Compiled by SSIE

Abyssal Environment	Algae - Phaeophyta
Acoustical Properties	Algae - Pyrrophyta
Activated Carbon	Algal Toxins
Adaptive Radiation	Aluminum
Adriatic Sea	American Samoa
Adsorption Capacity	Amino Acids
Advection	Ammonia
Aeration	Ammonium
Aerobic Bacteria	Amoeba
Aeromagnetics	Amphibians
Aerosols	Amphibious Operations
Aftershocks	Amphipods
Agricultural Wastes	Anaerobic Bacteria
Agulhas Current	Analysis of Variance
Air - Sea Boundary	Anchoring and Mooring
Studies	Systems
Heat and Radiation	Anchovies
Transfer	Andesite
Particle - Gas	Animal Migration
Transfer	Animal Toxins
Wind - Water	Annelida
Interaction	Oligochaeta
Air Census	Polychaeta
Air Motion	Anorthosite
Advection	Antarctic Ocean
Air Patterns and	Ross Sea
Circulation	Scotia Sea
Air Turbulence	Weddell Sea
Convection	Antarctica
Gravity Waves	Anthozoa
Wind	Antilles
Ocean - Lake Winds	Antimony
Orographic Effects	Antisubmarine Warfare
Wind Direction	Aquaculture
Wind Profiles	Fish Farming
Wind Shear	Plant Aquaculture
Wind Velocity	Shellfish Farming
Air Pollution	Aquaria
Monitoring	Arachnida
Air Pollution Sources	Arctic
Air Pollution Types	Arctic Ocean
Air Pressure - Density	Baffin Bay
Air Temperature	Barents Sea
Airboats	Beaufort Sea
Aircraft	Chukchi Sea
Alaska	East Siberian Sea
Albemarle Sound	Greenland Sea
Aleutian Islands	Hudson Bay
Algae	Laptev Sea
Algae - Chlorophyta	Lincoln Sea
Algae - Chrysophyta	Argon - Potassium Dating
Diatoms - general	Arsenic
Algae - Cyanophyta	Arthropods
Algae - Euglenophyta	Artificial Islands

Aschelminthes	Basalt
Nematoda	Basic - Mafic Rocks
Asteroids	Basins -sedimentary- structural
Atlantic Coastal Plain	Bathyal Environment
Atlantic Ocean -general	Bathymetry
Atlantic Ocean -north	Bathythermographs
Atlantic Ocean -south	Bauxite
Atmosphere Disturbance	Bay of Biscay
Cyclones - Anticyclones	Bayous
Fronts	Bay - Bights
Monsoons	Beaches
Severe Storms - Squalls	Beaufort Sea
Thunderstorms	Bed Load
Tornadoes - Waterspouts	Bedding Planes
Tropical Cyclones -	Beds Under Water
Hurricanes	Behavior - invertebrate
Atmosphere Electricity	Benefit-cost Analysis
Atmosphere Energy -	Benthic Fauna
Radiation	Benthic Flora
Air Temperature	Benthonic Environment
Heat Balance - Budget	Bering Sea
Heat Exchange	Bermuda
Atmosphere History	Beryllium
Atmospheric Pollution	Billfishes
Air Pollution Monitoring	Bioassays
Air Pollution Sources	Biochemical Evolution
Air Pollution Types	Biogenous Sediments
Aerosols	Bioindicators
Gases	Biological Oxygen Demand
Particulates	Biological Rhythms
Radioactivity	Spawning
Dispersion -	Bioluminescence
Transportation	invertebrate
Atolls	Biostratigraphy -
Atomic Plants	Biofacies
Australia	Biotelemetry
Azores and Madeira	Birds
Islands	Ducks, Geese, and Swans
	Gulls, Plovers, Etc.
	Pelicans, Cormorants, Etc.
B O M E X	Bituminous Shale
Bacteria	Black Sea
Aerobic Bacteria	Bluefishes
Anaerobic Bacteria	Boat Discharges
Coliforms -nonspecific	Boating
Escherichia Coli	Boats and Hydrofoil
Heterotrophic Bacteria	Crafts
Marine Bacteria	Bonin Islands
Pseudomonas - nonspecific	Borehole Geophysics
Bacterial Endotoxins	Brachiopods
Bacterial Exotoxins	Breakwaters
Bacteriophage	Breccia -general
Baffin Bay	British West Indies
Bait Fish Rearing	Bryozoans
Balloons	Buoys
Baltic Sea	
Barents Sea	
Barges	
Barium	Cadmium
Barnacles	Calcification
Bars	Calcium

California	Coastal Plain
California Current	Atlantic Coastal Plain
Canals	Gulf Coastal Plain
Canary Islands	Coastlines - Shorelines
Cancer	Cobalt
Cancer Chemotherapy	Coccoliths
Cape Verde Islands	Codfishes and Hakes
Capes - Peninsulas	Coelenterata
Carbon	Anthozoa
Carbon Dioxide	Hydrozoa
Carbon Isotopes	Scyphozoa
Carbonates	Coliforms -nonspecific
Carbon 14 Dating	Columbia River
Carbonates	Comb Jellies
Cargo and Passenger	Combined Sewers
Ships	Commodities
Caribbean Sea	Comparative Anatomy-
Carnivores	Evolution
Caroline Islands	Comparative Physiology
Cartilaginous Fishes	Compressional Waves
Catalogs, Tables,	Computer Models
Compilations	Condensation Physics
Cephalopods	Conglomerates
Cesium	Connecticut River
Cetacea	Conodonts
Channels	Continent History
Charts	Continental Drift
Chemical Analysis	Continental Shelf
Chemical Oxidation	Continental Slope
Chemical Reactions	Continents
Chemical Sediments	Convection
Chert	Convection Currents
Chesapeake Bay	Copepods
Chlorination	Copper
Chlorine	Coral Sea
Chlorophyll	Corals
Chromium	Core
Chukchi Sea	Core Analysis
Ciliata	Correlation
Cinder Cones	Corrosion, Deterioration
Cirrus Clouds	Corrosion Agents
Clams	Corrosion Effects
Clay Minerals	Fouling
Clay Soils	Stress Corrosion
Claystone	Thermal Degradation
Clouds	Corrosion Prevention
Cirrus Clouds	Corrosion Rates
Cloud Cover	Cosmogenous Sediments
Cloud Formation and	Costs
Evolution	Crabs
Cloud Motions -	Cratons - Platforms
Movement	Crayfish
Cloud Patterns	Creel Census
Cloud Physics	Creosote
Cloud Structure	Crinoids
Cumulus Clouds	Cruises
Clouds - Precipitation	Crust
Cnidosporidia	Crustacea
Coal	Barnacles
Coastal Engineering	Copepods

Eucarids	Dredging
Crabs	Drift Stations
Crayfish	Drilling and Coring
Lobsters	Drugs
Prawns	Drums
Shrimps	Ducks, Geese, and Swans
Ostracods	Dyes
Peracarids	
Amphipods	Earth Electrical Properties
Isopods	Earth Telluric Current
Crustal Movement	Exploration Methods
Detectors	Electric Logging
Crystal Chemistry	Electromagnetic Probing
Crystallization	Earth Interior
Cuba	Earth Magnetism
Cumulus Clouds	Exploration Methods
Currents -bottom	Aeromagnetics
Currents -longshore	Magnetic Surveys
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Cyclones - Anticyclones	Magnetic Field Character
Cyprus	Field Reversals
Cytotoxic Agents	Magnetic Intensity
	Paleomagnetism
DDE	Polar Wandering
DDT	Rock and Mineral Magnetism
Decompression Sickness	Secular Magnetic Variation
Deep Sea Drilling	Earth Thermal Properties
J O I D E S	Convection Currents
Deep Submersibles	Geothermal Gradient
Deformation	Heat Flows
Degradation	Earth Tides
Delaware Bay	Earthquake Location
Delaware River	Earthquakes
Deltas	East China Sea
Demand for Recreation	East Siberian Sea
Denitrification	Easter Island
Density, Sea Water	Echinoderms
Depth -water	Asteroids
Depth, Sea Water	Crinoids
Desoxyribonucleic Acid	Echinoids
Developmental Physiology	Holothuroids
Dew	Ecological Effects
Dewatering	Ecological Evolution
Diabase	Economic Mineral
Diatoms -general	Appraisals
Dicotyledons	Dimensions - Distribution
Dieldrin	Potential of Deposit
Digestion	Resource Inventories
Dikes	Economics
Dinoflagellates	Benefit-cost Analysis
Discharge	Commodities
Discontinuities	Fish and Shellfish
Disinfection	Economic Impact
Dispersion - Transportation	Income Analysis
Dissolved Load	International Economics
Divers	International Trade
Diving and Scuba Gear	Microeconomics
Dolomite	Costs
Domestic Wastes	Market Structure
Sanitary Landfills	Marketing
Sewage	Production and Processing

Natural Resources	Evolutionary Studies
Economics	Exchange Capacity
Land Economics	Experimental Geochemistry
Optimization	Exploration Methods
Regional Economics	Explosives
Regional Base Studies	Extinction
Regional Impact	Extrusive Igneous Rocks
Economics -recreation	Fats - Lipids and Oils
Effluent Standards	Ferry Boats
Effluents - Waste Water	Field Reversals
Elastic Waves	Fiji Islands
Electric Logging	Filtration
Electric Power Plants	Fine-grained Clastics
Electrical Properties	Fish
Electro-fishing	Anchovies
Electromagnetic Properties	Billfishes
Electronics	Bluefishes
Image Sensing Systems	Cartilaginous Fishes
Night Vision Detection	Ratfishes
Systems	Sawfishes
Remote Sensing Systems	Sharks
Element Ratios	Codfishes, Hakes
EM Radiation	Drums
Emergent Shorelines	Freshwater Catfishes
Energy - Environmental	Herring, Shad, Menhaden
Aspects	Jacks, Scads, Pompanos
English Channel	Killifishes
Entomology	Lampreys, Hagfishes
Environmental Effects	Lefteye Flounders
Environmental Hazards	Mackerels, Tunas
Environments, Human	Minnows, Carps
Pressure	Mullet
Decompression Sickness	Perches
Nitrogen and Inert	Porgies
Gas Narcosis	Righteye Flounders
Temperature and Humidity	Scorpionfishes, Rockfishes
Cold	Sea Basses
Enzyme Studies	Smelts
Eocene Epoch	Surfperches
Epeirogenic Movement -	Trout, Whitefish,
isostasy	Graylings
Equatorial Currents	Salmon
Erosion	Trout
Escherichia Coli	Whitefish, Cisco
Estuaries	Fish and Shellfish
Ethological Evolution	Fish Capture
Eucarids	Drugs
Eutrophication	Electro-fishing
Evaporation	Nets
Evaporites	Tags
Evolution, Organic	Telemetry
Biochemical Evolution	Fish Censusing
Comparative Anatomy-	Air Census
Evolution	Creel Census
Comparative Physiology	Questionnaires
Ecological Evolution	Fish Farming
Ethological Evolution	Fish Protein Concentrate
Genetic Evolution	Fish Spawning and
Geologic Evolution	Nesting
Speciation	

Fishing	Freshwater Circulation
Fishing Gear	Freshwater Currents
Fission Reactors	Freshwater Catfishes
Fission Track Dating	Freshwater Ecology
Fissure Eruptions	Fronts
Fjords	Fungi
Flagellata	Marine Fungi -
Floods	nonspecific
Florida	Yeasts -nonspecific
Florida Current	Fungicides
Flysch Deposits	
Fog - Haze - Mist	Gabbro
Fog - Mist Dissipation	Galapagos Islands
Food Chains	Gamma Radiation
Food Fish and Shellfish	Gases
Clams	Gastropods
Crabs	Gates
Fish -nonspecific	Genetic Evolution
Fish Protein	Geochemistry
Concentrate	Crystal Chemistry
Hake	Experimental Geochemistry
Lobster	High Pressure Research
Oysters	High Temperature
Salmon	Research
Scallops	Mineral Equilibria
Shrimp	Mineral Synthesis
Trout	Phase Relationships
Tuna	Solution Chemistry
Food Processing	Geochemical
Food Webs	Investigations
Foraminifera	Element Ratios
Formosa - Taiwan	Isotopic Abundance
Fossil Age Studies	Studies
Fossil Dating	Mineral - Rock
Fossil Invertebrates	Alterations
Arthropods	Mineral Associations
Ostracods	Mineral Genesis
Brachiopods	Trace Element
Bryozoans	Analysis
Coelenterates	Transfer Processes
Corals	Organic Geochemistry
Conodonts	Geochronology
Echinoderms	Fossil Dating
Mollusks	Radioactivity Methods
Protozoans	Argon - Potassium
Coccoliths	Dating
Dinoflagellates	Carbon 14 Dating
Foraminifera	Fission Track Dating
Radiolaria	Rubidium - Strontium
Silicoflagellates	Dating
Fossil Plants	Thorium Dating
Algae	Uranium Dating
Fossil Pollen	Geodesy
Fossil Preservation	Geodetic Mapping
Fossil Spores	Geodetic Surveys
Fossil Structure	Standard Geoid
Fossil Vertebrates	Geologic Evolution
Fish	Geologic Faults
Fossil Zones - Index	Rifts
Fossils	Thrust Faults
Fouling	Transform Faults

Geologic Folds	Greenland
Geologic History	Greenland Sea
Atmosphere History	Groins
Continent History	Gulf Coastal Plain
Glacial History	Gulf of Aden
Igneous - Metamorphic History	Gulf of Alaska
Island Arc History	Gulf of California
Ocean Basin History	Gulf of Guinea
Paleoclimatology	Gulf of Mexico
Paleogeography	Gulf Stream
Paleosalinity	Gulls, Plovers, Etc.
Paleotemperature	
Sea Level Changes	Hake
Sedimentary History	Handbooks
Tectonic History	Harbors
Geologic Maps	Hawaii
Geologic Time	Heat and Radiation
Mesozoic Era	Transfer
Paleozoic Era	Heat Balance - Budget
Precambrian	Heat Exchange
Quaternary Period	Heat Flows
Pleistocene Epoch	Heavy Metals
Recent Epoch	Herbicides
Tertiary Period	Herring, Shad, and
Eocene Epoch	Menhaden
Miocene Epoch	Heterotrophic Bacteria
Oligocene Epoch	High Pressure Research
Paleocene Epoch	High Temperature Research
Pliocene Epoch	Holothuroids
Geological Exploration	Hudson Bay
Geophones	Hudson River
Geosynclines	Humboldt or Peru Current
Geothermal Gradient	Humidity - Water Vapor
Glacial History	Hydrofoil Craft
Glaciers	Hydrographic Surveys
Gold	Hydrozoa
Government	Hyperbaric Chamber
Intergovernmental Relations	
Policy Making	Ice Studies
Granite	Ice Alteration
Gravity Studies	Ice Composition
Crustal Movement	Ice Jams
Detectors	Ice Petrofabrics
Exploration Methods	Ice Properties
Gravity Surveys	Ice Acoustics
Gravimeters -general	Ice Electrical Properties
Gravity Anomalies	Ice Mechanical Properties
Gravity Applications	Ice Thermal Properties
Isostasy	Ice Thickness - Area
Structural Analysis	
Gravity Tectonics	Icebergs
Gravity Waves	Icebreakers
Graywacke Sandstone	Iceland
Great Lakes	Igneous - Metamorphic History
Lake Erie	Igneous Activity -
Lake Huron	Volcanism
Lake Michigan	Igneous Petrogenesis
Lake Ontario	Igneous Rocks
Lake Superior	Basic - Mafic Rocks
	Extrusive Igneous Rocks

Andesite	Japan
Basalt	Java Sea
Rhyolite	Jetties
Tuff	
Intrusive Igneous	Killifishes
Rocks	Kuroshio Current
Anorthosite	
Diabase	L - Waves
Gabbro	Labrador Current
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Peridotite	Lagoons
Lava	Lake Erie
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Incineration	Lake Ontario
Income Analysis	Lake Superior
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Industries	Land Subsidence
Atomic Plants	Landfill
Electric Power Plants	Landing Crafts
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Information Systems	Larvicides
Infrared Radiation	Lasers - Masers
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Insecticides	Lefteye Flounders
DDE	Legal Studies
DDT	Law Enforcement
Dieldrin	Legal Review
Malathion	Legislation - Zoning
Insects	Legislative Levels
Int. Decade Ocean	Federal Government
Exploration	Local Government
Intelligence	State Government
Interceptor Stations	Pollution Taxes
Intergovernmental Relations	Limestone - general
International Economics	Lincoln Sea
International Trade	Line Islands
Interstitial - Connate	Lithostratigraphic Unit
Water	Lobsters
Intertidal - Littoral Areas	Local Government
Intrusive Igneous Rocks	Locks
Invertebrate Pathology	Logistics
Iodine	Long Island Sound
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Isotropy - Anisotropy	Magnetometers
	Malagasy Republic -
Jacks, Scads, and	Madagascar
Pompanos	Malathion
Jamaica	Malaysia - Malaya
James River	

Malta	Microseisms - Background
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Man in the Sea Programs	Logistics
Manganese	Military Operations
Mantle	Amphibious Operations
Mariana Islands	Antisubmarine Warfare
Marinas	Naval Operations
Marine Bacteria	Mineral - Rock
Marine Cables	Alterations
Marine Fouling	Mineral Associations
Marine Fungi -	Mineral Content -water
nonspecific	Mineral Equilibria
Marine Materials	Mineral Genesis
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Marine Photography-	Mineralogy
Television	Carbonates
Marine Pollution	Silicates
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Industrial Wastes	Minnows and Carps
Ocean Dumping	Miocene Epoch
Petroleum Wastes -	Mississippi River
Spillage	Mobile Bay
Radioactivity	Mollusks
Sewage	Cephalopods
Ship Wastes	Clams
Marine Productivity	Gastropods
Marine Propellers	Oysters
Marine Safety	Pelecypods -other
Marine Salvage	Molybdenum
Marine Soils	Monitoring and Baselines
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Marketing	Monsoons
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Marshall Islands	Orogeny
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Mercury	Natural Gas
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Metabolism -invertebrate	Economics
Metals -general	Naval Operations
Heavy Metals	Naval Personnel
Trace Metals	Naval Ships - Warships
Metamorphic Petrogenesis	Navigation
Metamorphic Rocks	Nematoda
Metasomatism	Neritic Sublittoral
Meteorological	Areas
Condensation	Nets
Condensation Physics	New Guinea
Dew	New Hebrides Islands
Fog, Haze, Mist	New York
Microeconomics	New Zealand
Microfossils	Nickel
Micrometeorology	Night Vision Detection
Micronesia	Systems

Nitrogen	Ocean Fans
Ammonia	Ocean Fracture Zones
Ammonium	Ocean Hydrodynamics
Nitrates	Ocean Level Recorders
Nitrites	Ocean Meterological
Nitrogen and Inert Gas	Studies
Narcosis	Ocean Mining
Noncombatant Ships	Ocean Mixing
North Pacific Current	Ocean Motion Recorders
North Sea	Ocean Optical Devices
Norwegian Sea	Ocean Plains - Plateaus
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Nuclear Explosion	Rises
Nuclear Power Systems	Ocean Sediments
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Nucleic Acids and	Biogenous Sediments
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Desoxyribonucleic Acid	Marine Soils
Ribonucleic Acid	Precipitates
Nutrient Pollutants	Terrigenous Sediments
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Occupations	Sediment Acoustic
Divers	Properties
Military Personnel	Sediment Biology
Naval Personnel	Sediment Chemistry
Scientists	Sediment Mechanical
Ocean - Lake Winds	Properties
Ocean Banks	Sediment Origin
Ocean Basin History	Sediment Physical
Ocean Basins	Properties
Ocean Bottom Sampling	Sediment Textures -
Devices	Structures
Ocean Circulation -	Sediment Thickness -
general	Area
Ocean Convection -	Sedimentation
Advection	Ocean Surface
Ocean Coring and Dredging	Environment
Ocean Currents	Ocean Trenches
Currents -bottom	Ocean Waves - Currents
Currents -longshore	Oceanic - Pelagic
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Currents -ocean	Oceanographic Ships
Agulhas Current	Offshore Power Plants
California Current	Oil Removal
Equatorial Currents	Oligocene Epoch
Florida Current	Oligochaeta
Gulf Stream	Oolitic Limestone
Humboldt or Peru	Optical Properties,
Current	Sea Water
Kuroshio Current	Optimization
Labrador Current	Ordnance
North Pacific Current	Underwater Ordnance
Yucatan - Gulf Loop	Warships
Current	Ore Deposits
Ocean Dumping	Beryllium
Ocean Energy	Chromium
Ocean Engineering -	Copper
general	Gold

Iron	Particulates
Manganese	Pearl River
Platinum	Peat
Thorium	Pelicans, Cormorants, Etc.
Tin	Peracarids
Uranium	Perches
Organic Deposits	Peridotite
Organic Geochemistry	Periphyton
Organics	Permafrost - Frozen
Organism Sampling	Soils
Devices	Permeability
Orogenic Belts	Persian Gulf
Orographic Effects	Pesticide Accumulation
Ostracods	Rates
Outfall Sewers	Environment
Oxygen	Accumulation Rates
Oysters	Tissue Accumulation
	Rates
P - Waves	Pesticide Analysis
Pacific Ocean -east	Bioassay
Pacific Ocean -general	Chemical Analysis
Pacific Ocean -north	Metabolites from
Pacific Ocean -south	Pesticides
Pacific Ocean -west	Monitoring Systems
Paleo-oceanography	Pesticide Persistence
Paleocene Epoch	Pesticide Toxicity
Paleoclimatology	Residues in Food
Paleoecology	Petrogenesis
Paleogeography	Igneous Petrogenesis
Paleomagnetism	Crystallization
Paleontology	Magmatic
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Evolutionary Studies	Petrogenesis
Adaptive Radiation	Petrography
Extinction	Petroleum
Speciation	Petroleum Wastes -
Fossil Age Studies	Spillage
Fossil Pollen	Phase Relationships
Fossil Preservation	Philippine Sea
Fossil Spores	Philippines
Fossil Structure	Phosphorus
Fossil Internal	Phosphates
Structure	Phosphorus Isotopes
Shells	Physical Models
Microfossils	Physiological Effects
Paleoecology	Phytoplankton
Biostratigraphy -	Piers
Biofacies	Pillow Lava
Fossil Zones - Index	Pilot Plants
Fossils	Pinnipeds
Population -	Pipelines
Distribution	Piscicides
Paleosalinity	Plankton
Paleotemperature	Phytoplankton
Paleozoic Era	Zooplankton
Pamlico Sound	Plant Aquaculture
Panama	Plant Morphology
Particle - Gas	Plate or Block
Transfer	Tectonics

Platinum	Pseudomonas -nonspecific
Platyhelminthes	Public Health
Trematoda	Puerto Rico
Turbellaria	Puget Sound
Pleistocene Epoch	Pumps
Pliocene Epoch	
Plumes	Quaternary Period
Plutonium	Questionnaires
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Bioindicators	Radioactive Isotopes
Chemical Identification	Radioactivity
Pollutants, Path of	Radioactivity Methods
Pollution Effects	Radioisotopes
Ecological Effects	Radiolaria
Environmental Effects	Radiosondes -
Physiological Effects	Rawinsondes
Pollution Taxes	Radium
Polychaeta	Radon
Polynesia	Rain
Porgies	Rappahannock River
Porifera	Rate of Deposition
Porosity	Ratfishes
Ports	Recent Epoch
Potassium	Recreation
Potential of Deposit	Boating
Potomac River	Demand for Recreation
Prawns	Economics -recreation
Precambrian	Fishing
Precipitates	Recreation Law
Pressure	Safety -recreation
Pressure, Sea Water	Seasonal Homes
Primary Productivity	Swimming
Probability and	Touring
Statistics	User Patterns
Probability	Red Sea
Stochastic Processes	Reefs
Statistics	Regional Economics
Analysis of Variance	Regional Impact
Correlation	Regression Analysis
Regression Analysis	Remote Sensing
Sampling	Aircraft
Time Series Analysis	EM Radiation
Production and Processing	Gamma Radiation
Productivity	Infrared Radiation
Primary Productivity	Microwave Radiation
Secondary Productivity	Radar
Propulsion	Visible Light
Electrical	Lasers - Masers
Marine	Satellites
Nuclear	Remote Sensing Systems
Protozoa	Reproduction
Ciliata	Reptiles
Cnidosporidia	Rescue Boats
Flagellata	Residues in Foods
Sarcodina	Resource Inventories
Amoeba	Rhodophyta
Foraminifera	Rhyolite
Protozoans	Ribonucleic Acid

Rifts	Trace Elements
Righteye Flounders	Sea Water Mass and
Ripple Marks	Ocean Fronts
River Deltas	Sea Water Properties
Rock and Mineral	Acoustical Properties
Magnetics	Density, Sea Water
Rodents	Depth, Sea Water
Ross Sea	Electrical Properties
Rubidium - Strontium	Electromagnetic
Dating	Properties
Ruthenium	Optical Properties,
	Sea Water
S - Waves	Pressure, Sea Water
Safety -recreation	Shock Propagation
Saline Water Intrusion	Temperature, Sea Water
Salinity	Thermal Properties,
Salmon	Sea Water
Salt	Thermocline
Salt Domes	Thermodynamics
Salt Marches	Turbidity, Sea Water
San Andreas Rift	Sea Water Sampling
San Francisco Bay	Seamounts - Guyots
Sand Dunes	Seasonal Homes
Sands and Gravels	Secondary Productivity
Sandstones	Secular Magnetic Variation
Sanitary Landfills	Sediment Acoustic
Sarcodina	Properties
Sargasso Sea	Sediment Biology
Satellites	Sediment Deposition
Savannah River	Rate of Deposition
Sawfishes	Sediment Thickness
Scallops	Sediment Diagenesis
Scandium	Sediment Lithification
Scientists	Metasomatism
Scorpionfishes and	Calcification
Rockfishes	Sediment Cementation
Scotia Sea	Sediment Origin
Scouring	Sediment Properties
Scuba	Adsorption Capacity
Scyphozoa	Exchange Capacity
Sea Basses	Permeability
Sea Cliffs	Porosity
Sea Floor Spreading	Sediment Composition
Sea Floor Topography	Chemical Composition
Sea Ice	Interstitial - Connate
Sea Level Changes	Water
Sea Level Variations	Organic Composition
Sea of Japan	Sediment Texture
Sea of Okhotsk	Sediment Provenance
Sea Walls	Studies
Sea Water Chemistry	Sediment Thickness - Area
Chemical Reactions	Sediment Transport
Oil Removal	Transport Agents
Radioactivity	Glaciers
Salinity	Icebergs
Sea Water Analysis	Ocean Waves -
Gases	Currents
Heavy Metals	Turbidity Currents
Organics	Transport Direction
Particulates	Transport Distance

Transport Methods	Seismic Wave
Bed Load	Characteristics
Dissolved Load	Wave Attenuation
Suspension	Wave Dispersion
Sedimentary History	Wave Propagation
Sedimentary Rocks	Wave Reflection
Carbonates	Wave Refraction
Dolomite	Wave Shape - Amplitude
Limestone -general	Wave Velocity
Oolitic Limestone	Stress-strain Relations
Chemical Sediments	Earth Tides
Bauxite	Microseisms -
Conglomerates	Background Noise
Evaporites	Wave Propagation Media
Salt	Isotropy - Anisotropy
Fine-grained Clastics	Plastic, Elastic,
Claystone	Semi-solid
Marl	Wave Types
Mudstone	Compressional Waves
Shale	Elastic Waves
Siltstone	L - Waves
Organic Deposits	P - Waves
Bituminous Shale	S - Waves
Peat	Shear Waves
Sandstones	Surface Waves
Graywacke Sandstone	Selenium
Siliceous Sediments	Severe Storms - Squalls
Chert	Sewage
Tectogenic Clastics	Sewage System- Treatment
Breccia -general	Plant
Flysch Deposits	Combined Sewers
Melange	Effluent Standards
'Tuffaceous Sediments	Flushing Devices
Sedimentary Structures	Interceptor Stations
Bedding Planes	Sewage System Design
Ripple Marks	Sewage Treatment Plants
Sedimentation	Small Sanitation Units
Seiches	Transportation of Sewage
Seismic Instruments	Shale
Geophones	Shark Repellents
Seismographs	Sharks
Strain Gauges	Shear Waves
Tiltmeters	Shellfish Farming
Seismology	Shells
Exploration Methods	Shields
Seismic Mapping	Ship Assemblages &
Seismic Reflection	Components
Seismic Refraction	Marine Propellers
Seismic Surveys	Ship Hulls
Generation Mechanisms	Submarine Hulls
Aftershocks	Ship Design -general
Earthquakes	Ship Instruments
Explosives	Ship Motion
Nuclear Devices	Ship Stability
Seismic Applications	Ship Wastes
Earthquake Location	Shipboard Computers
Nuclear Explosion	Ships and Boats
Structural Studies	Anchoring and Mooring
Seismic Stations and	Systems
Networks	Boats and Hydrofoil

Crafts	Spits
Airboats	St. Lawrence River
Ferry Boats	Standard Geoid
Hydrofoil Craft	State Government
Rescue Boats	Statistics
Tug Boats	Steam
Naval Ships - Warships	Stochastic Processes
Landing Crafts	Stocking of Fish and
Submarines	Shellfish
Noncombatant Ships	Storm Modification
Barges	Storm Surge
Cargo and Passenger	Strain Gauges
Ships	Strait of Gibraltar
Icebreakers	Straits - Channels
Oceanographic Ships	Stratigraphy
Tankers	Specific Rock Units
Shoals	Lithostratigraphic Unit
Shock Propagation	Stratigraphic Section
Shoreline Development	Stratigraphic Sequence
Shoreline Structures	Time - Stratigraphic
Shrimps	Unit
Silicates	Stratigraphic Correlation
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Silicoflagellates	Subsurface Stratigraphy
Siltstone	Streams
Silver	Deposition Features
Sludge Treatment and	River Deltas
Disposal	Stream Morphology
Sludge Disposal	Stress Corrosion
Incineration	Stress-strain Relations
Landfill	Strontium
Ocean Dumping	Strontium Istotopes
Sludge Treatment	Structural Analysis
Dewatering	Structural Studies
Digestion	Sub-bottom Structure
Small Sanitation Units	Submarine and Diving
Smelts	Medicine
Snake River	Submarine Canyons
Snow	Submarine Hulls
Sodium	Submarines
Soils Geology	Submerged Soils
Soil Pollution	Submergent Shorelines
Soil Properties	Subsurface Stratigraphy
Soil Chemical	Sulfur
Properties	Sulfates
Soil Moisture	Sulfides
Soil Salinity	Surface Waves
Soil Types	Surfperches
Clay Soils	Suspension
Permafrost - Frozen	Susquehanna River
Soils	Swamps - Marshes
Submerged Soils	Swimming
Solid Waste Management	Synoptic Weather
Solomon Islands	Observations
Solution Chemistry	
Sonar	Tags
Sounds	Taiwan Strait
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Spawning	Tectogenic Clastics
Speciation	Tectonic Features

Basins -sedimentary- structural	Touring
Continents	Toxic Substances
Cratons - Platforms	Algal Toxins
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Earth Interior	Bacterial Endotoxins
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Discontinuities	Cytotoxic Agents
Mantle	Tetrodotoxin
Geosynclines	Trace Element Analysis
Island Arcs	Trace Elements
Land Bridges	Trace Metals
Mountains - Massifs	Tracers
Ocean Basins	Dyes
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Salt Domes	Tracheophyta
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Tectonic History	Transport Direction
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Deformation	Transportation
Epeirogenic Movement - isotasy	Transportation of Sewage
Gravity Tectonics	Trematoda
Igneous Activity - Volcanism	Trinidad
Land Subsidence	Tropical Cyclones - Hurricanes
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Temperature, Sea Water	Turbidites
Terrigenous Sediments	Turbidity - water
Tertiary Period	Turbidity Currents
Tetrodotoxin	Turbines
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Thermal Pollution	Hydraulic
Thermal Properties, Sea Water	Steam
Thermocline	Turbulence - ocean
Thermodynamics	Tyrrhenian Sea
Thorium	Under-water Construction
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	Vertebrate Sound Production

Virgin Islands	Weather Modification
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Visible Light	Storm Modification
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Volcanoes	Networks
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Volcanic Vents	Radar
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	Rawinsondes
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	Towers
Wake Island	Weathering - geologic
Wakes	Weddell Sea
Warships	Weirs
Waste Water Treatment	Welding
Activated Carbon	Wetlands
Aeration	Whitefish and Cisco
Chemical Oxidation	Willamette River
Chlorination	Winches
Degradation	Wind
Denitrification	Wind - Water Interaction
Disinfection	Wind Direction
Filtration	Wind Profiles
Water Balance - Budget	Wind Shear
Wave Action	Wind Velocity
Wave Attenuation	Wisconsin
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Wave Propagation	Creosote
Wave Propagation Media	
Wave Reflection	Yeasts - nonspecific
Wave Refraction	York River
Wave Shape - Amplitude	Yucatan - Gulf Loop
Wave Types	Current
Wave Velocity	
Wave-built Terraces	
Wave-cut Terraces	Zinc
Waves - internal	Zirconium
Waves - ocean	Zoogeography
Weather Forecasting	Zooplankton

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